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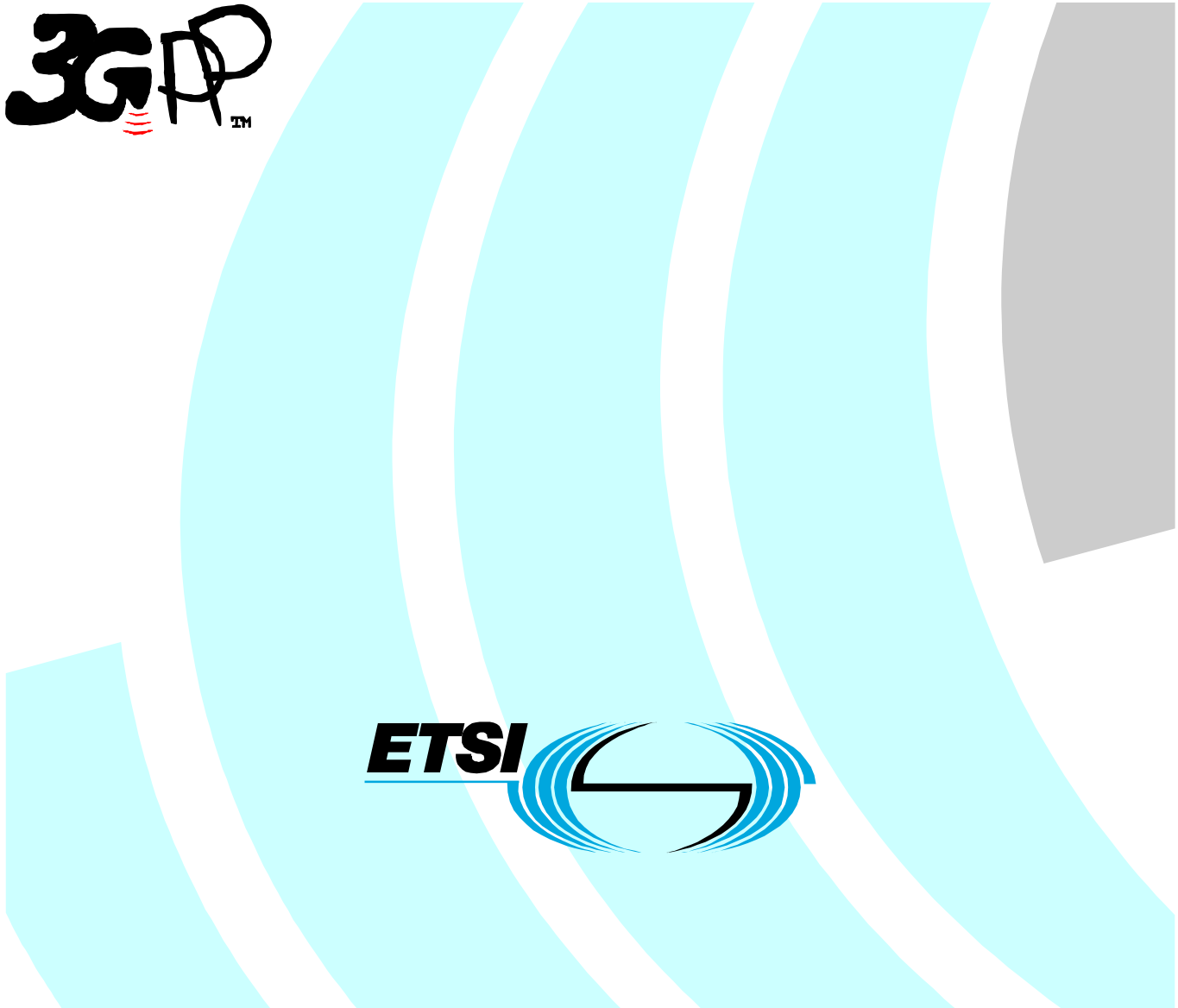
Technical Specification

Universal Mobile Telecommunications System (UMTS);
FDD enhanced uplink;
Overall description;
Stage 2
(3GPP TS 25.309 version 6.0.0 Release 6)



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Foreword

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
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1 Scope

The present document is a technical specification of the overall support of FDD Enhanced Uplink in UTRA.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 25.896: "Feasibility Study for Enhanced Uplink for UTRA FDD".

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [2] and the following apply:

E-DCH: Enhanced DCH, a new dedicated transport channel type or enhancements to an existing dedicated transport channel type.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [2] and the following apply:

E-TF	E-DCH Transport Format
HARQ	Hybrid Automatic Repeat Request
HSDPA	High Speed Downlink Packet Access

4 Background and Introduction

The technical objective of the FDD Enhanced Uplink work item is to improve the performance of uplink dedicated transport channels, i.e. to increase capacity and throughput and reduce delay. This work item is applicable for UTRA FDD only.

Among the techniques considered in [1], the following techniques are part of the work item:

- Node B controlled scheduling: possibility for the Node B to control, within the limits set by the RNC, the set of TFCs from which the UE may choose a suitable TFC,
- Hybrid ARQ: rapid retransmissions of erroneously received data packets between UE and Node B,
- Shorter TTI: possibility of introducing a 2 ms TTI.

5 Requirements

- The Enhanced Uplink feature shall aim at providing significant enhancements in terms of user experience (throughput and delay) and/or capacity. The coverage is an important aspect of the user experience and that it is desirable to allow an operator to provide for consistency of performance across the whole cell area.
- The focus shall be on urban, sub-urban and rural deployment scenarios.
- Full mobility shall be supported, i.e., mobility should be supported for high-speed cases also, but optimisation should be for low-speed to medium-speed scenarios.
- The study shall investigate the possibilities to enhance the uplink performance on the dedicated transport channels in general, with priority to streaming, interactive and background services. Relevant QoS mechanisms shall allow the support of streaming, interactive and background PS services.
- It is highly desirable to keep the Enhanced Uplink as simple as possible. New techniques or group of techniques shall therefore provide significant incremental gain for an acceptable complexity. The value added per feature/technique should be considered in the evaluation. It is also desirable to avoid unnecessary options in the specification of the feature.
- The UE and network complexity shall be minimised for a given level of system performance.
- The impact on current releases in terms of both protocol and hardware perspectives shall be taken into account.
- It shall be possible to introduce the Enhanced Uplink feature in a network which has terminals from Release"99, Release 4 and Release 5. The Enhanced Uplink feature shall enable to achieve significant improvements in overall system performance when operated together with HSDPA. Emphasis shall be given on the potential impact the new feature may have on the downlink capacity. Likewise it shall be possible to deploy the Enhanced Uplink feature without any dependency on the deployment of the HSDPA feature.

6 Overall architecture of enhanced uplink DCH

6.1 Protocol architecture

The following modifications to the existing nodes are needed to support enhanced uplink DCH:

UE

A new MAC entity (MAC-e) is added in the UE located below MAC-d. MAC-e in the UE handles HARQ retransmissions, scheduling and MAC-e multiplexing. TFC selection is part of MAC-d. It is FFS if MAC-e also includes TFC selection functionality.

Node B

A new MAC entity (MAC-e) is added in Node B which handles HARQ retransmissions, scheduling and MAC-e demultiplexing.

S-RNC

A new functionality is added in MAC entity in the SRNC to provide in-sequence delivery (reordering) and to handle combining of data from different Node Bs in case of soft handover.

The resulting protocol architecture is shown in Figure 6.1-1:

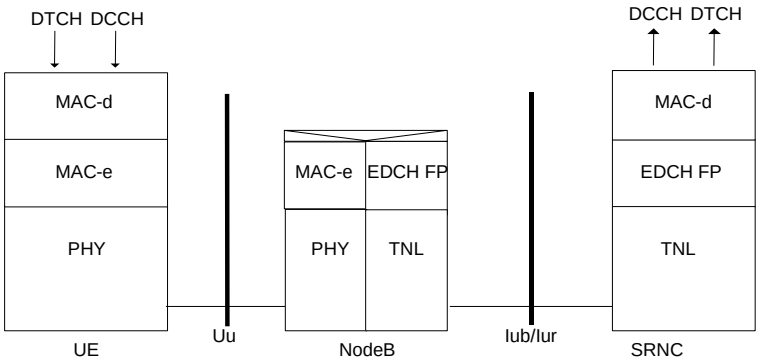

Figure 6.1-1: Protocol Architecture of E-DCH

6.2 Transport channel attributes

The E-DCH transport channel has the following characteristics:

- E-DCH and DCH are using separate CCTrCHs
- There is only one CCTrCH of E-DCH type per UE;
- There is only one E-DCH per CCTrCH of E-DCH type;
- There is only one transport block per TTI;
- Both 2 ms TTI and 10 ms TTI are supported by the E-DCH. The support of 10 ms TTI is mandatory for all UEs. The support of 2 ms by the UEs is FFS (always optional or mandatory for high UE categories).

6.3 Basic physical structure

6.3.1 UL Physical layer model

6.3.2 DL Physical layer model

7 MAC architecture

7.1 General Principle

7.1.1 MAC multiplexing

The E-DCH MAC multiplexing has the following characteristics:

- MAC-d multiplexing is supported;
- Multiple MAC-d flows can be configured for one UE;
- Different QoS characteristics can be associated to the MAC-d flows. Based on them, the MAC-e entity in the UE decides on the HARQ operation parameters (Beta factors, etc). For each transmission, the MAC-e entity gives the HARQ operation parameters to the L1 in addition to the TFRC;

- The design goal is to allow and define rules for the multiplexing of data from different MAC-d flows within the same MAC-e PDU. Details are FFS.

7.1.2 Reordering entity

The re-ordering entity is in a separate MAC sub-layer in the UE and the SRNC. The assumption is that the re-ordering is done per priority (re-ordering) queues and that the entity is located just below MAC-d. It is FFS, if it is found that the additional overhead is acceptable, to do the re-ordering per logical channels. In that case, the re-ordering entity would be located just above MAC-d.

7.2 MAC architecture – UE side

7.2.1 Overall architecture

7.2.2 Details of MAC-d

7.2.3 Details of MAC-c/sh

7.2.4 Details of MAC-hs

7.2.5 Details of MAC-e

7.3 MAC architecture – UTRAN side

7.3.1 Overall architecture

7.3.2 Details of MAC-d

7.3.3 Details of MAC-c/sh

7.3.4 Details of MAC-hs

7.3.5 Details of MAC-e

8 HARQ protocol

8.1 General Principle

The HARQ protocol has the following characteristics:

- Stop and wait HARQ is used;
- The HARQ is based on synchronous downlink ACK/NACKs;
- The HARQ is based on synchronous retransmissions in the uplink:
  - The number of process numbers depends on the TTI (i.e. 2ms or 10ms). The target is to have one value per TTI. The exact numbers are FFS;
  - There will be an upper limit to the number of retransmissions (details are FFS);
- Intra Node B macro-diversity and Inter Node B macro-diversity should be supported for the E-DCH with HARQ;
- Incremental redundancy shall be supported by the specifications with Chase combining as a subcase:
  - The first transmission shall be self decodable;
  - The set of incremental redundancy versions to be applied by a UE for any E-TF (E-DCH Transport Format) is under the control of the UTRAN;
  - The set of incremental redundancy versions may be E-TF dependent. For some E-TF, the incremental redundancy version may be linked to the CFN. For other E-TF, it may be explicitly signalled. When and how is FFS;
  - There shall be no need, from the H-ARQ operation point of view, to reconfigure the Node B from upper layers when moving in or out soft handover situations. However, the Node-B may be aware of the soft handover status via a soft handover indicator;
- Details on how to cycle through the different incremental redundancy versions are FFS.

8.2 Error handling

8.3 Signalling

8.3.1 Uplink

8.3.2 Downlink

In the downlink, a report is used to indicate either ACK (positive acknowledgement) or NACK (negative acknowledgement).

9 Node B controlled scheduling

9.1 General Principle

The Node B controlled scheduling is based on uplink and downlink control together with a set of rules on how the UE shall behave with respect to this signaling.

In the downlink, a resource indication (scheduling grant) is required to indicate to the UE the maximum amount of uplink resources it may use.

The scheduling grants have the following characteristics:

- Scheduling grants are only to be used for the E-DCH TF selection algorithm (i.e. they do not to influence the TFC selection for the DCHs);
- It is FFS whether the scheduling grant controls the maximum allowed in terms of E-DPDCH/DPCCH power ratio, E-DCH TF index, E-DPDCH+DPDCH/DPCCH power ratio, other…
- All grants are deterministic;
- Scheduling grants can be sent once per TTI or slower;
- There are two types of grants:
  - The absolute grants provide an absolute limitation of the maximum amount of UL resources the UE may use;
  - The relative grants increase or decrease the resource limitation compared to the previously used value;
- Absolute scheduling grants are supported:
  - They are valid for one UE, for a group of UEs or for all UEs;
  - They can have an associated duration;
  - Except if sent to all UEs, the absolute scheduling grant contains at least the identity of the UE (or group of UEs) for which the grant is intended and the maximum resources the UE(s) may use;
- Relative grants (updates) are supported as a complement to absolute grants:
- The combination of absolute and relative grants to get the total grant is FFS;
- The operation in soft handover is FFS;
- The interaction between HARQ and scheduling is FFS.

9.2 Signalling

9.2.1 Uplink

For the UE to request resources from the Node B(s), scheduling requests will be transmitted in the uplink (details are FFS).

9.2.2 Downlink

The absolute scheduling grants are transmitted using a shared channel.

The relative scheduling grants are transmitted using dedicated resources.

10 TFC selection

Logical channels mapped on the DCHs are always prioritised over those mapped on E-DCHs.

The principle of the TFC selection across E-DCH and DCH is the following:

- The UE maintains a list of allowed TFCs for the CCTrCH of DCH type;
- The UE performs the TFC selection for the DCHs;
- Every E-DCH TTI, the UE shall estimate the remaining power;
  - Then it performs the TF selection for the E-DCH, with the estimated remaining power, based on logical channel priorities like in the R99;
  - In addition, the UE may need not to go below a minimum rate for the E-DCH. In some case, this means that the UE may have to power scale down all physical channels present;
  - In order to be backward compatible, some E-DCH minimum set support is needed. Details are FFS.

11 Signalling parameters

11.1 Uplink signalling parameters

11.2 Downlink signalling parameters

12 Mobility procedures

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
09/2004	RP-25	RP-040358	-		Approved at TSG-RAN #25 and placed under Change Control.	1.0.0	6.0.0

History

Document history		
V6.0.0	September 2004	Publication